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The Quiet Revolution in India's Food Supply Chains

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CONTENTS

Abstract	iv
Acknowledgments	v
1. Introduction	1
2. Emerging transformation <i>Downstream</i> in India's Food Supply Chains: The Takeoff of the Supermarket Revolution	4
3. Emerging Transformation <i>Midstream</i> : In the Processing Sector	7
4. Emerging Transformation <i>Midstream</i> : In the Wholesale and Logistics Sector	10
5. Conclusions: A Quiet Revolution in India's Food Supply Chains is Emerging but Still Constrained	18
References	19

ABSTRACT

There has been a rapid transformation of food supply chains in India over the past two decades. Modern retail sales are growing at 49 percent per year and quickly penetrating urban food markets and even rural markets. The food-processing sector is growing quickly while also concentrating and undergoing a rapid increase in the capital-output ratio, with little increase in employment. A modern segment is emerging in the wholesale sector, with the penetration of modern logistics firms and specialized modern wholesalers. However, the broad traditional segment of the wholesale sector is also transforming; supply chains are *shortening*, as village brokers are reduced to a minor role and as *mandi* (public wholesale markets) wholesalers buy direct from farmers. In addition, cold stores have expanded rapidly and have taken on wholesale functions (even to the extent of supplanting wholesale markets) and provide credit to farmers. This all indicates a ferment of change in supply chains, which in the medium/long run can transform the conditions faced by farmers. By far, the main actors in this unfolding *quiet revolution* are the private sector—whether modern or traditional; the government's direct role (as buyer and seller) is only 7 percent of the food economy of India. The private sector, both modern and traditional, decides the food security of India. Policies that enable and provide encouragement to that sector to invest will decide the future of food security. Addressing pending policy and regulatory constraints and spurring public investment in hard and soft infrastructure will be crucial to that encouragement.

Keywords: India, wholesale markets, supply chains, farmers, supermarkets, food processing, logistics, cold chain, food markets

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1. INTRODUCTION

This paper focuses on the structural transformation of food supply chains from rural to urban areas in India. We focus on the transformation in the supply stream—*downstream* (that is, in the retail segment of the supply chain) and *midstream* (that is, in the food processing and wholesale/logistics segments of the supply chain)—as the changing market context that will condition and influence the path of agriculture and food security in the coming decades. Due to space constraints in this paper, we do not explore the emerging evidence and potential impacts of these changes on the farm sector; instead, we refer the reader to Reardon and Minten (2011b), who focused on those impacts.

Rural–urban supply chains—and the transformation of them—are crucial to the food security of urban Indians, which numbered about 79 million (around 18 percent of the population) in 1961, approximately 350 million in 2010 (greater than the population of the United States), and an estimated 590 million by 2030 (40 percent of the Indian population and greater than the current entire European Union) (India, Ministry of Home Affairs)¹ The food supply chain is also crucial to the incomes of hundreds of millions of those employed in rural and urban areas as farmers, wholesalers, truckers, processors, and retailers participating in these supply chains.

There have been four principal changes in India’s rural–urban food supply chain over the past several decades.² First, the food supply chain’s volume has tripled in the past three decades: urban food expenditures have tripled (in real terms) over the past 35 years, to US\$45 billion by 2006 (based on a series of representative national household surveys from the National Sample Surveys [NSSs]). The trend is an *urbanizing* of the Indian food market: In 1971, urban food expenditures made up about one-quarter of total national food expenditures in 1971, whereas by 2006, this had become more than one-third. This increase has been nearly completely supplied by domestic production, as India exports and imports a very small share of its food economy and exports more food than it imports (now and 35 years ago).

Second, the food supply chain’s composition has diversified over the past three decades. The share of cereal consumption in the urban food basket has declined from 36 percent in 1972 to 23 percent in 2006. In the same period, the share of cereals in rural areas declined from 56 to 32 percent (Indiastat). Just weighting by urban and rural population (thus abstracting from income differences), we find that roughly 29 percent of India’s food economy was in cereals in 2006, versus roughly 52 percent in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India’s food consumption and are important sources of calories, protein, and vitamins. These foods share center stage with grains for food security.

Third, the government’s direct role in the marketing of grain output doubled over the three decades, from 12 percent of grain output in the 1970s to 24 percent in the early 2000s (our calculations weight by rice and wheat shares and abstract from grains other than rice and wheat, using parastatal procurement shares of grain output as cited in Rashid, Cummings, and Gulati 2007). However, the government’s role in food marketing as a share of the overall food economy is very small and has stayed nearly constant over the three decades—at 6 percent in the early 1970s to 7 percent by the mid-2000s. (We found this by multiplying the government procurement shares times the share of grains in the food economy.) The government, as a direct player, is a very minor actor in the Indian food economy. Although the government has transformed the grain economy by increasing the market share of the *parastatal* at the margin—from 12 to 24 percent—the grain economy and the overall food economy are overwhelmingly operated by the private sector (mainly traditional private players (*mandi* traders, private mills, village brokers, traditional retailers), but increasingly also modern private sector (agribusiness and large food processing companies, supermarkets).

¹ These estimates may even be substantial underestimates of urban shares in India, as discussed in Sivaramakrishnan, Kundu, and Singh (2005).

² We focus on the chain from farm to retailer or consumer. However, there is also substantial transformation in the segment upstream from the farm—the farm-input supply segment. We do not treat this segment in this paper; for an excellent analysis, see Pray and Nagarajan (2011).

Fourth, the private part of India's food economy, which constitutes 93 percent of the food economy, has been structurally transforming rapidly especially over the past decade. It is on this transformation that the rest of the paper focuses; therefore, we provide scant detail here in the introduction. In comparison with traditional market channels (fragmented, small traditional processors; shops; wet markets; hawkers; and village brokers), all *modern*³ market channels—both private-sector led (modern retail, food processing, food service industry) and public-sector led (parastatal wholesaling, processing, and retail)—show higher annual growth rates than do overall urban food expenditures:⁴

- Modern food retail has been estimated to have grown 49 percent annually from 2001 to 2010 (Reardon, Timmer, and Minten 2010; Reardon and Minten 2011a).
- The food service industry (restaurants, fast-food, takeaway, cafes/bars, food stalls/kiosks) grew 9 percent annually from 2001 to 2006 (Euromonitor International 2007).
- The processing sector (mainly the formal sector, as discussed below) grew 7 percent (in real terms) from 2002 to 2006 (Ministry of Food Processing 2008).
- Parastatal grain procurement grew 7 percent from 1996 to 2006 (Reserve Bank of India, Indiastat).

Compare these rates with urban food expenditure's growth of only 3.4 percent annually (in real terms) over the past 10 years (based on the NSSs, National Sample Survey Organisation (NSSO), several years) and with the all-India food expenditure, which is even slower at 2.5 percent. This comparison indicates the increasing relative and absolute importance of modern channels in India's food supply chains.

The food economy's diversification into non-cereals and its structural transformation gradually away from traditional into increasingly modern market channels are driven (as working hypotheses based on our research) by several factors:

- (1) Urbanization and attendant lifestyle and employment changes (and thus an increase in the opportunity costs of women's time) have encouraged the rise of food processing, food away from home, and modern retail.
- (2) This urbanization's effect was reinforced by a rapid increase in ownership of vehicles and *white goods* (that is, kitchen appliances, such as mixers and refrigerators). The National Council for Applied Economic Research (NCAER 2005) and Ablett et al. (2007) have shown that from 1995 to the end of the 2000s, the yearly purchase of vehicles in India increased by about 15-fold, while that of kitchen durables increased by about fourfold. Most of this increase was in urban areas. The effect was substantial. For example, by 2007, about one-third of India's urban population had refrigerators, which allow for less-frequent purchases of fresh foods.
- (3) While per capita incomes grew only slightly from the 1960s through the 1980s, there has been strong per capita growth since the liberalization of the economy in the 1990s. This liberalization has increased the food expenditure *pie* and driven diversification from grains into nonstaples per the well-known relation of Bennett's law, which predicts that the share of cereals in total food expenditure declines with income.
- (4) A series of reforms of the agricultural and food economy (some of which, such as dereservation⁵ of small enterprises, go beyond the food sector) have encouraged

³ Following Reardon et al. (2009), we use the term *modern* to refer to recent evolutions in the marketplace. If modernization is equated with improved efficiency, then public-sector-led supply chains, such as cooperatives and parastatals, might fail that test.

⁴ The processing and the food service industries consist of an informal and a formal modern sector. With the data available, it is difficult to obtain separate numbers on the growth rates of these sectors. However, for both, the formal sector is significantly more important than the informal sector in terms of the share of output (for more details, see Section 3).

⁵ Dereservation refers to a sector's being taken off a list of sectors that by regulation were allowed to only have small

modern private-sector players (for example, retailers, processors, logistics firms, modern wholesalers) to emerge and, in some cases, to procure directly from farmers. These reforms have been progressively enacted over the past decade—in some cases pan-India and in other cases over some states but not others. These reforms are discussed further in Section 5.

The aforementioned fourfold transformation of rural–urban food supply chains, driven by the four sets of factors, ushers in the era of India’s modernizing food economy. In this brief paper, we focus on the fourth change—the structural transformation. We proceed from the *downstream* segments in the supply chain (retail and food service) to the *midstream* segments (processing and wholesale). While we find a substantial ferment of change—both in the emergence of the modern sector and in the transformation of the traditional market channels—we end with a discussion of persisting constraints to this transformation. As neutral scientists, we do not take a position on whether these constraints should be lifted, as this is a political decision for the Indian people; however, we do lay out the factors that we think continue to limit the speed and depth of the transformation of supply chains.

enterprises operating. This effectively means large enterprises can now operate in that sector.

2. EMERGING TRANSFORMATION *DOWNSTREAM* IN INDIA'S FOOD SUPPLY CHAINS: THE TAKEOFF OF THE SUPERMARKET REVOLUTION

Food retail is transforming in India's cities - in stores as well as in food service establishments, such as restaurants and fast-food chains. We focus on the example of the rise of modern food retail in chains of supermarkets, hypermarkets, convenience stores, and neighborhood stores.

An emerging and potentially important factor in the medium to long run in transforming rural-urban food supply chains in India is the rise of modern food retail. We draw several points from work done in 2010/11 (Reardon, Timmer, and Minten 2010; Reardon and Minten 2011a), which analyzed and reviewed the recent changes with a unique dataset and a substantial set of key informant interview case studies, and which reviewed earlier research, such as Joseph et al. (2008) and others.

Reardon and Minten (2011a) noted three surprises concerning the rise of Indian modern food retail that make its path somewhat different from other developing countries' recent supermarket revolutions. First, modern retail in India has developed in three waves. The first wave was of government retail chains, started in the 1960s and 1970s. The second wave was cooperative retail chains, starting in the 1970s and 1980s. The third has been the rise of private retail chains in the 1990s and 2000s. This third wave occurred in two phases. The first phase, from roughly the mid-1990s to the early 2000s, was southern-India focused, middle-class centered, and domestic-foreign joint ventured. It also was very small compared with the second phase. The second phase, which started in the mid-2000s and has proceeded to the present (and we expect it to continue for some years), has occurred throughout India and is mainly in the middle class, though in some formats and places it has moved into the lower-middle and upper working class, as well as into smaller cities and even rural towns. The second phase has been mainly driven by domestic capital.

The surprise about this first trend is not that there were waves of modern retail rise starting with state retail and then cooperatives and then private retail chains. Indeed, this has been a common pattern in a number of other developing countries. Rather, the surprise has been that right into the takeoff of private modern retail in the past five or six years, the state chains (such as Fair Price Shops [FPS]) are still a major force (for example, the FPS equivalent of a major chain), as are the cooperative retail chains, such as Mother Dairy/Safal (again, equivalent in sales to a major private chain). This means three different modern retail transformative models vie and compete to diffuse food system change.

Second, the rise of modern private retail in India in the past six years has been among the fastest in the world, growing at 49 percent per year (in U.S. dollar terms) on average over that period and bouncing back to growth after a dip from the recent recession. The great majority (around 75 percent) of modern private retail arose from 2006 to 2010, which tracks closely with a Delhi-specific study by Minten, Reardon, and Sutradhar (2010), which showed similar rates.

By 2010, the sales of the leading 20 private chains that sold food were roughly US\$5 billion, of which about US\$2.5 billion was for food. This is roughly 5–6 percent of urban food retail (figured roughly with a denominator of US\$45–50 billion of total urban food expenditures, as noted previously). Therefore, it is still a small share of the market. However, this share was much below 1 percent even 6 years earlier, so the change was rapid but early. Also, the above share for private retail is corroborated by the findings of Minten et al. (2010) for Delhi, where it has been shown that supermarkets' grain share is 7 percent and fresh produce share is around 4–5 percent.

The Indian numbers are striking given the very recent rise of supermarkets; however, they are still behind a number of other Asian situations (such as in Beijing, where the share of supermarkets in rice retail has reached 50 percent, which is still much below that of places like Hong Kong [Reardon et al. 2010]). Moreover, if one extrapolates forward to 2020, at the present growth rate of sales, the share of supermarkets could attain 20–30 percent of food retail in cities, which may become even higher after the liberalization (allowing 51 percent ownership for multi-brand retail) of foreign direct investment (FDI) in retail that occurred in August 2011 (PlanetRetail, 2011, 12 August).

Moreover, the above estimate of the *private* modern retail share is certainly an underestimate of overall modern food retail. As we noted earlier, the overall modern food retail includes both state and cooperative

chains, which may add as much as another 3 or 4 percent to the 5–6 percent noted above (with the state and co-op retail share a rough estimate based on a review of the size and number of these chains; see Reardon and Minten 2011a). Moreover, even the private retail chains share is an underestimate of all private modern retail, as the above is only from the leading private chains; beyond those are the small regional and city-specific chains, which may together add another percentage point to the total. Thus, food sales of all types of modern chains may be as much as 10 percent of urban food retail, or US\$4–5 billion. This amount is still less than one-third of India's food exports (US\$17 billion in 2008, per FAOSTAT), but at the current rate of growth of modern retail (which is about twice as fast as food exports are growing), in 5–10 years, modern food retail may be a more important modern market than exports for India.

The third surprise is that Indian private retail chain development has unique or rare characteristics: (a) It is driven by domestic capital investment, rather than by the more common FDI-driven retail expansion seen in many other developing countries; (b) it is *early* (in terms of usual international patterns) in diversifying into small format stores; (c) it is early in its penetration of small cities and even rural towns and areas, such as rural business hubs like DCM Shriram Consolidated's Hariyali Kisaan Bazaar and ITC's Choupal Saagar; and (d) it is early in its initial penetration of the food markets of the poor and lower-middle class and of fresh produce retail. These unique factors have helped propel the rapid diffusion of private retail chain development.

Space limits do not allow us to discuss in detail the drivers of the three retail trends. However, we do lay out what we hypothesize to be 10 main determinants of these trends: (1) food insecurity and persistent poverty; (2) rapid income growth; (3) the rise of the middle class in India; (4) the rapid increase in expenditures on consumer durables and fast-moving consumer goods (FMCG); (5) urbanization—overall and growth of Tier 2 and 3 cities and towns; (6) growth of the rural economy; (7) partial liberalization of FDI distribution; (8) partial liberalization of procurement rights of retailers; (9) retail transformation via government and cooperative investments from the 1960s and 1970s onward; and (10) rapid growth in investible funds from the financial sector, corporate earnings, and remittances.

The growing importance of modern retail might have important effects on the rural–urban food supply chain. First, modern retail appears to be having emerging effects both midstream and upstream in the food supply chain (Reardon and Minten 2011b; Minten et al. 2009). On the one hand, supermarkets typically offer a large selection of staples and processed and semiprocessed products, reflecting the larger emphasis on these types of products in urban areas, which may serve to expand, concentrate, diversify, and modernize the food-processing sector. On the other hand, for their fresh produce needs, modern retailers in India, as in other developing countries, currently rely on a mixture of procurement mechanisms, including sourcing from brokers on wholesale markets in spot transactions, from specialized and dedicated intermediaries on wholesale markets, from their own collection centers, and a bit from their own farms. Given the current small scale of modern retail operations, procurements from wholesale markets through brokers and through wholesale markets are seemingly the most important procurement method. However, some large investors in the modern retail sector (for example, Reliance) are engaged in peri-urban collection centers, where traditional market channels are bypassed, especially for perishables like leafy greens for large city stores. Farmers usually gain in these settings, because transaction costs are reduced due to lower transport costs (collection centers are set up close to producers), faster turnaround (no auctions take place and no waiting for buyers is necessary), reliable weighing, transparent pricing, and immediate payments. However, modern retail establishments often have strict requirements regarding the produce they purchase, and they often procure only better-quality products. This often means that when supermarkets procure directly from farms in India, they do so from small or medium rather than marginal farmers and from farmers with more nonland assets, such as irrigation.

Second, there is emerging evidence that modern retail charges lower prices than traditional retail, which may prove an urban food security boon from retail transformation. Relying on their primary survey of traditional and modern retailers in Delhi, Minten et al. (2010) showed that prices charged for a number of products (rice, wheat flour, vegetables, fruit, edible oil) were lower than or at the same level as those charged by traditional retailers. The authors speculate that these modern retailers might deliver these products at cheaper rates because of more efficient procurement systems through better supply chain

management and better in-store and in-distribution-center inventory management and handling. However, the study also showed that in these early stages of modern retail rollout, there are important quality delivery constraints, especially in the case of the supply chains of fresh fruits and vegetables.

3. EMERGING TRANSFORMATION *MIDSTREAM*: IN THE PROCESSING SECTOR

The food-processing sector has also been transforming in the past two decades. The following trends are salient.

First, there has been increasing consumption of processed food, mirrored by the increasing size of the processing sector. The output of the food-processing industry has doubled over the past 15 years: climbing from 628 billion rupees in 1984/85, to 991 billion in 1994/95 to 1,215 billion in 2000/01 (Bhavani, Gulati, and Roy 2006).

Second, the share of processed food in total food consumption is higher than typically thought, even though the share of moderately and highly processed food is still only about 50 percent of food in urban areas and 40 percent in rural areas. Morisset and Kumar (2008) divided the food consumption basket into different levels of processed food and showed the following patterns for 2004/05:

- (a) Primary products are those consumed without processing include fruits and vegetables, eggs, and fluid milk at the farm. Nonprocessed products form only 16.8 percent of food consumption in urban areas and 15.3 in rural areas. Thus, roughly 83–85 percent of Indian food products are consumed processed.
- (b) *First-processing products with low value added* are defined as products that undergo minimal processing, such as dehusking, milling, drying, and grinding. Examples are rice, flour, pulses, spices, and dried fruits. Value addition is estimated at 0–5 percent. These products form 34.8 percent of food expenditure in urban and 43.9 percent in rural areas.
- (c) *First-processing products with high value added* undergo more complicated processing and have a larger value added—between 5 and 15 percent. There is no adding of ingredients, and products are not mixed. Examples are dairy products, such as butter and curd, as well as meat, fish, and sugar. These products form 38.2 percent of food expenditure in urban areas and 35.1 percent in rural areas.
- (d) *Second-processing products* are those that have as an input a first-processed product and to which another product (a flavor, a preservative, or another ingredient) is added. Examples include biscuits, bread, ghee, ice cream, and jam. These form 10.2 percent of urban food expenditure and 5.7 percent of rural.

Third, processed food consumption rises with income and urbanization. Morisset and Kumar (2008) compared the level of consumption of processed food to income level in urban areas. When they divided the urban population into 12 income categories, they found that the poorest and richest groups spend about 30 percent and 58 percent, respectively, of their food budget on a relatively highly processed food category (categories (c)–(d)). This result implies that when incomes rise, the consumption of processed food increases in importance, which is a typical result globally, including in developing countries (Wilkinson 2004). Unfortunately, no analysis has been performed on changes in the share of processed food (of various levels of processing) over a longer period in India.

Fourth, Morisset and Kumar (2008) presented evidence of changes over subsector shares in the composition of the processing sector. Five traditional sectors—oil and fats, grain, sugar, dairy, and tea and coffee—dominate the food-processing industry with 80–85 percent of total processing output, employment, and factories. Of these five large industries, three (oils and fats, grain, and dairy) showed an annual growth rate in output that was larger than the average for the processing sector in recent years; thus, they are growing in relative importance. While for grains, oil, and sugar, the processing share is at or near 100 percent by the nature of these products, for other sectors, processing is relatively unimportant. For example, it is estimated that only 2 percent of fruits and vegetables are processed in India (India Brand Equity Foundation 2006).

Fifth, there is emerging evidence of consolidation in the Indian food-processing industry. This is at least partially driven by the dereservation. In 1987/88, 18 food-processing subsectors were reserved for small enterprise (Bhavani, Gulati, and Roy 2006, citing Development Commission for Small Scale Industries 1992). Bhavani, Gulati, and Roy (2006) noted that from 1997 to 2007, half of these subsectors were dereserved, leaving only pickles/chutneys, some vegetable oils, bread and pastry, sugar confections, and spice grinding as reserved, and tobacco and alcoholic beverages as still licensed. They also noted that no licensing was required at that time for other subsectors. Moreover, foreign direct investment (FDI) in food processing was eased: Automatic investment approval was granted for FDIs up to 51 percent of foreign equity or 100 percent (if by a nonresident Indian) for most subsectors, except reserved subsectors, malted food, and alcoholic beverages. The policy reforms also allowed 24 percent foreign ownership of small-scale firms. More important, food-processing machinery could be freely imported and exported, and custom duties on materials and machinery were strongly reduced. The government even provided full tax exemption for the first five years of food-processing company operation to encourage new investment. In addition, export zones were set up to encourage food-processing export.

Although dereservation appears to be one important factor in driving change in processing, there has been no statistical analysis of its impact on consolidation in processing. One sees evidence of the latter already occurring before dereservation, so it would seem that dereservation, as well as the other recent policies, are but part of the set of factors driving structural change in processing.

Based on historical data from the organized (formal, modern) and unorganized (traditional, informal) segments, Bhavani, Gulati, and Roy (2006) argued that clear consolidation in the organized sector is taking place at the factory level; there is also evidence of scaling up (increasing output per factory) and capacity expansion (fixed capital per factory). The food-processing industry is split into two segments for statistical and regulatory reasons: the organized and the unorganized segments.⁶ The share of the organized segment in total output has been increasing over time, as measured by the value of gross output. Bhavani, Gulati, and Roy (2006) showed that the organized sector increased from 64 percent in 1984/85 to more than 80 percent in 2000. Yet 85 percent in 2000/01 (similar to 87 percent in 1985) of processing employment is in the unorganized segment.

Moreover, Reardon and Minten (2011b) argued, using procurement information from Indian supermarkets, that there is a symbiosis between large processors and modern retail. They argued that the former have logistics strategies (such as direct delivery to chains and produce assortment and packaging) that is desired by supermarkets. In addition, supermarket chains tend to select as their suppliers the large processors, due to product assortment, low transaction costs, and scale to supply all stores. The large chains and large processors in India may help each other develop and win market share from traditional sector rivals, as has also occurred in Latin America (see, for example, Farina 2002).

That the output and employment shares are so different implies large labor productivity differences between the two segments. Reardon and Minten (2011b) argued that although the organized segment is increasing its output share, it is expected that the unorganized segment will remain dominant in terms of the number of manufacturing units and employment. In some industries, however, there is evidence of absolute decline in numbers of small firms. For example, Das Gupta et al. (2010b) showed that for paddy milling (into rice), the share of manual mills (typically very small, village-based, informal sector mills that were dominant in the 1960s and 1970s) has dropped to very little over time in central Uttar Pradesh; the same is true of single-roller mills (which are also more labor intensive). By contrast, there has been a rise of semiautomatic and automatic mills, more efficient and with much larger capacities than the village mills they supplant.

Sixth, Bhavani, Gulati, and Roy (2006) showed that from 1984/85 to 2000/01, the total value of fixed assets of the processing sector jumped from 192 to 469 billion rupees (2.44 times). Over the same period, output jumped from 628 to 1,215 billion rupees (1.93 times). Thus, there was a clear trend of capital–output ratio increase, or capital deepening, in food processing. By contrast, employment in food processing

⁶ The organized sector consists of units that employ more than 10 people and that use power or of units that employ at least 20 people and that use no power. Other units are categorized in the unorganized sector.

increased from 10.39 million to 12.06 million rupees in the 15 years (1.16 times). These simple ratios show that the capital–labor ratio doubled over the 15 years studied. The large output growth with little employment growth seen in food processing mirrors a broader and similar process found by Dehejia and Panagariya (2011) in Indian manufacturing and services. Note, however, that this technology change was afoot before machinery-import liberalization and before dereservation. Thus, pending is a statistical analysis of what caused these technology changes, as the policies that are oft discussed can be but one part of the picture.

Moreover, the capital intensification happened faster in the organized sector, as one would expect. During the 15 years studied, the share of the organized sector in the processing sector's fixed assets jumped from 26 to 61 percent. At the same time, the organized segment's share of the number of firms in the processing sector stayed about constant (from 0.53 to 0.76 percent and back to 0.52 percent over the 15 years). The number of firms dropped from 4.66 million in 1985 to 3.85 million in 1995 and then increased net to 5.14 million by 2001.

Seventh, there is emerging evidence of private modern processors vying with cooperative processors and apparently displacing them, or at least reducing the cooperatives' market share. An example of a cooperative that processes (and also retails) is the National Dairy Development Board. Cooperatives play at least a minor role in milk (with approximately 10 percent of the market) as well as a role in grains, jute, cotton, sugar, areca nuts, and fruits and vegetables. Acharya (2004) estimated that cooperatives handled about 10 percent of all marketed surplus in the country in the early 1990s. However, the importance of cooperatives seems to be declining. For example, in a review of India's agribusiness sector, ANZAC (2005) argued that there are a limited number of successful market-sustainable cooperatives outside the dairy sector. Yet not all of these dairy cooperatives have been successful, and although they might still be growing in absolute numbers, they are increasingly losing market share compared with the private sector in the dairy value chains. For example, Sharma and Singh (2007) reported that the private sector's share in (organized-sector) milk-processing plants increased from 49 percent in 1996 to 66 percent in 2006; in addition, although the private sector and the cooperative sector held about equal shares in milk procurement in the organized dairy value chain in 2006, the private sector is projected to be twice as important in procurement in 2011 (Gupta 2007).

Eighth, it is not clear what impact the transformation of the processed food sector has had on farmers. There are few survey-based studies on the procurement practices of processing firms (such as Dev and Rao [2005] for gherkins and palm oil in Andhra Pradesh), and more research is required. It seems that the processing firms rely to a large degree on brokers and traditional wholesale markets. Unless the processing industry has specific quality requirements,⁷ firms usually do not buy directly from farmers and seem to rely instead on dedicated brokers and wholesalers for the procurement of their produce (Singh 2007). There are, however, exceptions—for example, in grains and oilseed (Singh 2007). In general, there are few requirements for raw produce; in addition, it is often lower-quality products, especially with regard to fruits and vegetables, that are procured at lower prices for processing (Fafchamps, Vargas-Hill, and Minten 2008).

⁷ This is the case for some dairy companies, such as Reliance and Nestlé, or for suppliers of international companies. For example, Nijjer Agro Foods in Amritsar is supplying processed vegetables to international companies, such as Unilever and Nestlé, and buys raw tomatoes and chilies directly from farmers. However, raw fruit for processing into pulp is sourced through independent contractors.

4. EMERGING TRANSFORMATION *MIDSTREAM*: IN THE WHOLESALE AND LOGISTICS SECTOR

There have been two sets of trends—one government drive and the other private-sector driven—in the transformation of the wholesale sector in India. We treat these in the two subsections below.

Government-Driven Transformation of the Wholesale Sector over the Past 50 Years

As with retail, in wholesale, the Indian government (particularly at the state level) has played a direct transformational role by acting as a wholesaler. The government has also played an indirect transformational role by regulating and investing in the wholesale sector. Both of these roles gave rise to trends and policies that had echoes in many other developing countries at roughly the same time (Reardon and Timmer 2007). We treat each of these in turn.

Direct Transformational Role: Government Steps into Market as a Wholesaler

In the 1960s, the government set up a parastatal to directly procure grain as a wholesale entity. This plan was conceived because of the assumption that the traditional wholesaler exploited farmers and in markets engaged in profiteering, and speculating. The government set itself up as a substitute to the private traders for a part of the market. The direct involvement was aimed at maintaining and controlling reserve stocks, influencing market prices, and subsidizing (through on-selling in its forward-integrated retail system, the Fair Price Shops) the poor (Rashid, Cummings, and Gulati 2007).

This role has gradually increased over the past three decades, but only in the grain sector. Note that the government's direct role in the overall food sector is very minor, with its share in total food expenditure (market and subsistence) remaining nearly steady for 30 years at only 6–7 percent of the overall food economy. However, in the grain quarter of the food economy, the government's direct roles in procurement (as wholesaler) and marketing (as retailer) of grain output doubled over the three decades, from 12 percent of grain output in the 1970s to 24 percent in the early 2000s. (Our calculations weight by rice and wheat shares and abstract from grains other than rice and wheat, using parastatal [Food Corporation of India] procurement shares of grain output as cited in Rashid, Cummings, and Gulati [2007].⁸) We term this a transformational role in that it is a shift from traditional wholesale (via brokers in villages and wholesalers in *mandis*) toward an organized system of wholesale procurement.

Rashid, Cummings, and Gulati (2007) pointed out that the opposite trend has occurred in other countries in Asia. Using the example of paddy, they noted that from the early 1970s to 2001–2003, the share of paddy procured by government shifted from the first to the second percentage in the following countries: (1) Bangladesh—from 1.52 percent to 3.11 percent; (2) India—from 9.82 percent to 25.26 percent; (3) Indonesia—from 3.54 percent to 6 percent; and (4) the Philippines—from 6.13 percent to 2.68 percent. Thus, India is a strong outlier.

Indirect Transformational Role: Government Sets Up Wholesale Sector Infrastructure and (Partially) Regulates Private Wholesale

To transform the wholesale sector from the traditional system, the Indian government undertook investment and regulation to integrate and concentrate into nodes (rather than the fragmented and diffuse structure of the traditional system) the wholesale sector and control or at least influence its terms of trade. To those ends, a public wholesale market system, as well as a concomitant marketing regulation, was developed from the 1960s onward, as follows.

⁸ The shares we note in the text are government procurement of grain output. Because the marketed surplus rate is less than 100 percent, the shares of government procurement in total marketed surplus of grains are higher than the above shares. Gulati, Ganguly, and Shreedhar (2011) found that 43 percent of the marketed surplus of rice and wheat was procured in 2008/09.

First, as in many other developing countries since the 1950s and 1960s, India built public wholesale markets (*mandis*). The first several five-year plans, which started in 1951, emphasized building physical wholesale markets, storage structures and warehouses, and transport lines (The Expert Committee on Agricultural Marketing [2001], known as the Guru Report). It is estimated that in 1947 (the year of India's independence), there were only 268 wholesale markets. By 2004, there were 5,964, with 2,143 primary *mandis*, 2,810 secondary *mandis*, and 1,011 nonregulated *mandis* (our calculations are taken from lists at www.agmarknet.nic.in). An example is the primary mandi—Azadpur—in Delhi. This large *mandi* covers 43 acres, with 438 big stalls of 600 square feet each, 796 small stalls of 200 feet each, and four million tons of fruits and vegetables exchanged per year in recent years. Although Azadpur is the largest *mandi* in India, it is still only about half the size of the leading wholesale market in Beijing (Xinfadi) in acreage and yearly volumes, and it is much smaller than large wholesale markets in Latin America (such as those in Mexico City or São Paulo).

Second, although our focus in terms of wholesale sector regulation is on the Agricultural Produce Market Committees (APMC) Act, we emphasize that it is but one of a series of wholesale sector regulations in India spanning pre- and post-independence, from the 1930s to present. The report of the Expert Committee on Agricultural Marketing (2001)—important because it initiated a decade of market reforms—enumerated 25 regulations on the food sector enacted from the 1930s to the 1990s. The produce marketing regulation (APMC), which started in the 1960s and 1970s, merely fits within the general trend. Moreover, there were a panoply of marketing public institutions set up during the third five-year plan (in the mid-1960s). Again, the APMC at the state levels merely fit into this general trend of forming government bodies to implement the regulations, while also investing in the sector's infrastructural development.

Signaled by the central government with the enactment of overall APMC legislation in the 1960s, each state deliberated and then chose (or did not choose) to enact a state-specific regulation along the general guidelines and set up an APMC⁹ to regulate wholesale and make investments in the wholesale markets' infrastructure. From the 1960s through the 1980s, most states and union territories adopted APMA legislation and established APMCs. This, in turn, required states to build and maintain (through market tax financing) the *mandis*, with licensed and registered (but private-sector) commission agents (CAs) and licensed traders in the yards. All wholesale trade was then required to pass via the APMC yards, paying a commission to the CAs, as well as a tax to the market, to off-loaders and loaders, and to the *weighing men* who registered the transaction.

The injunction that all wholesale trade, and thus purchase from farmers, must pass through the APMC *mandi* forbade (by implication) contract farming, collection centers by private retailers or wholesalers or processors, direct marketing from farmers to consumers, and private wholesale yards. In short, this injunction was aimed at funneling all trade from farmers to consumers through the APMC *mandis* at some point. This was originally designed to break the back of what was conceived to be an exploitative private trader system and was echoed in several other countries (such as Turkey, Brazil, and South Africa) that had similar regulations (Turkey still has).

However, although wholesale sector regulation and public investment via the APMC Act is an important transformation from the traditional system—and a significant control on the wholesale sector—it is nevertheless more ambiguous and has been implemented more partially (even before its eventual partial reform in the past half-decade) than seems commonly noted in public debate. Several points are relevant to this.

First, the 2001 Guru Report noted that although this regulation (as well as institutions and investments) tended to be at the central government and the state level down to the level of wholesale markets, it tended to not penetrate to the more local level. To illustrate that point, they noted that as of 2000, nearly all the

⁹ The committee is empowered to establish markets, control and regulate the admission of traders to the market, charge fees (market, license, and rental), issue and renew licenses, and suspend or cancel licenses. Over time, APMCs have emerged as a government-sponsored marketing services monopoly that prohibits such innovations as contract farming and that does not allow traders to buy outside the specified market yards (Acharya 2004). While the APMC also collects significant revenues from market fees, the infrastructure in most markets is largely deficient, as revenues are often directed toward other ends by the government (Umali-Deininger and Sur 2007; Fafchamps, Vargas-Hill, and Minten 2008).

states had an APMC that regulated to the level of the wholesale *mandis*, but that 27,294 rural periodic markets existed at the more local level. In addition, the committee estimated that only about 15 percent of the rural periodic markets functioned “under the ambit of regulation.”

Second, of the 28 states, three do not have APMCs. Two of those three states have not adopted APMC, while the state of Bihar had adopted it but then repealed it. Moreover, one of the states (Tamil Nadu) adopted APMC in 1987, but its original form already allowed for the elements that became the reforms (discussed below), such as direct marketing, that essentially made use of the government *mandis* nonmandatory.

Third, there is evidence that in states where APMC was enacted, not all *mandis* were regulated, nor did farmers sell everything through the regulated *mandis* in their areas. This appears to be why Shilpi and Umali-Deininger (2008) found in their 2005 survey of the state that only 10 percent of the sampled *mandis* were APMC-regulated and that farmers sold much of their produce to non-APMC-licensed buyers. The authors also performed surveys in Uttar Pradesh, Orissa, and Maharashtra, where they found that 85 percent, 90 percent, and 95 percent, respectively, of the sampled *mandis* were APMC regulated. Thus, even in APMC states (in 2005), the application of the regulation over *mandis* was somewhat partial. Shilpi and Umali-Deininger’s (2008) farmer surveys also showed that farmers did not sell only via regulated markets.

Fourth, even where APMCs are in force—and thus, in principal, where traders from outside the area and private-sector actors (such as processing firms and supermarket chains) are supposed to buy via the regulated *mandis*—there is evidence that implementation of the regulation is incomplete or skirted. Das Gupta et al. (2010a), in a survey in western Uttar Pradesh, found that potato trade had shifted substantially from the Agra *mandi* to take place at the cold storages. However, these examples do not necessarily establish a strong or clear pattern. For example, other survey-based studies with opposite findings, such as Fafchamps, Vargas-Hill, and Minten (2008), showed that farmers sold most of their fruit and vegetables directly to traders in the wholesale markets—not only in situations where regulations require it, but also in cases where the regulations do not require it (such as in study states where the APMC Act had not been enacted or had been reformed).

Fifth, just because a state uses the APMC does not mean that modern retailers cannot become among the licensed intermediaries. For example, the Spencer’s (chain) collection center in Karnataka, which started in 2001, had obtained a license as a regular yard of the APMC (author field interviews, 2007).

We have gone into detail about the partialness of the application, implementation, and penetration of the APMC Act to emphasize that even though there is an image of the Indian wholesale sector being highly and completely regulated (before reform), it appears that has in fact been somewhat—or even very—partial in its implementation. That is, the state-led transformation of the wholesale sector from its traditional form has been only partial. There is no systematic empirical analysis of this point, however, so we leave it as a general proposition.

Private Sector (Modern and Traditional) Driven Transformation of the Wholesale Sector over the Past 10 Years

APMC Reform and Entry of Private Modern Sector into Direct Wholesale

By the early 2000s, there was a crescendo of criticism of the APMC system, emphasizing both its inadequate performance relative to its purpose and the narrowness of its purpose relative to the emerging needs for wholesale and logistics services in India’s transforming overall food economy. The first critique—the APMC system’s inadequate performance—was set out by the Guru Report (Expert Committee on Agricultural Marketing 2001), the main points of which we summarize here.

The report starts by acknowledging that the APMC regulated markets did some of what they were originally intended to do—to redress problems in marketing. It then goes on to say that the initially promising approach developed into a system fraught with problems, as follows: (1) APMC has had limited success; (2) the requirement that trade must pass via the APMC *mandi* has hurt competition; (3) licensing has given way to entry barriers; (4) APMCs were supposed to control unethical practices in the *mandis* but

have often let those practices happen; and (5) APMCs were supposed to collect taxes and fees and use them for infrastructure development but often have not.¹⁰ The report's findings have been echoed in a number of other reports (such as Acharya 2004).

Although we have found only scant empirical research on *mandis* in India (in terms of representative sample surveys of *mandis* or of traders, retailers, or farmers using *mandis*), the few studies that do exist tend to corroborate most of the general critiques noted above. The *mandi* trader system is not efficient (Mattoo, Mishra, and Narain 2007; Ramaswami and Balakrishnan 2002; Umali-Deininger and Deininger 2001; Thomas 2003). (2) *Mandis* tend to lack market integration (Palaskas and Harriss-White 1996). (3) The *mandi* system is plagued with trader collusion (Banerji and Meenakshi 2004). (4) It is hypothesized¹¹ that the traditional channels to and from *mandis* are characterized by a high level of physical wastage (Mattoo, Mishra, and Narain 2007). (5) The wholesale market infrastructure for staple and nonstaple crops is not very developed. For example, the majority of wholesale markets are not paved, and there are few grading or cold storage facilities. In addition, sanitation facilities are largely deficient, with few public toilets, inadequate drainage, and little or no coordinated pest control (Fafchamps, Vargas-Hill, and Minten 2008).

Driven by the above critiques and by the segments of political support for reform and market liberalization in general, various reforms have affected the wholesale sector over the first decade of the 2000s. On the one hand, a series of reforms in the 2000s affect the wholesale sector, including the following: (1) liberalization of foreign direct investment (FDI) in food wholesale (including in cash-and-carry chains, such as Metro), with clientele required to be registered resellers and not consumers (PlanetRetail 2008, May 5); (2) removal of restrictions on FDIs (up to 100 percent) in bulk handling and storage; (3) removal or reduction of licensing requirements, stocking limits, and movement restrictions on wheat, paddy/rice, coarse grains, edible oilseeds, and edible oils; (4) initiation of a warehousing receipts program; (5) establishment of futures and forward markets and other commodity exchanges; and (6) enactment of the Food Safety and Standards Act of 2006. On the other hand, there was a major reform of the APMC system in 2003, with the Model Act for State Agriculture Produce Marketing (Development and Regulation). The amended act proposes to each state (for that state's ratification and implementation) the removal of the restriction of farmer direct marketing. (Under the regulated system, notified products can be sold only at markets to licensed traders.) It also proposes the opening of market infrastructure development to other agencies (especially the private sector), as well as the establishment of a framework for contract farming. The text of the model act, usable by states, is shown here: <http://agmarknet.nic.in/amrscheme/FinalDraftRules2007.pdf>.

However, the Model APMC Act has been adopted by only about half the states. The government of India shows (in a list in <http://agmarknet.nic.in/amrscheme/apmcstatus08.htm>) that from 2003 to end 2009, the adoption by states of APMA reform. We discussed earlier the four states where the reforms are not applicable. Of the other 28 states, 18 have fully adopted (but not necessarily fully implemented) the reforms; for those adopters, we have no systematic information regarding the extent of implementation. In our own interviews in Maharashtra, for example, we found that although the adoption may be full, the implementation may be slow or partial or complicated. Yet, we assess this as substantial progress in these reforms given the short period in which the Model Act was presented, debated hotly with substantial resistance (which continues), and partially adopted. Two of the states (Haryana and Punjab) have adopted parts of the Model Act. However, seven states still have not adopted. Although several of these seven states

¹⁰ Fafchamps, Vargas-Hill, and Minten (2008) did an extensive survey of *mandis* in Maharashtra, Orissa, Tamil Nadu, and Uttar Pradesh. They found that the infrastructure and services of the *mandis* were generally poor. Moreover, in our interviews with the Maharashtra State Agriculture Marketing Board in March 2009, the government noted that there were only 265 APMC *mandis* in Maharashtra in 2006 (at the time of the APMC amendment); of those, they noted that only 5 percent had cold storage, packing areas, and grading facilities.

¹¹ We emphasize *hypothesized* here because we have been able to find very few empirical studies of actual wastage in food supply chains in India. Anecdotes, opinions, and assertions abound, and various reports (like Mattoo, Mishra, and Narain 2007) cite "key informant" information. However, actual survey studies of wastage are mainly missing. The ones we have found showed that wastage rates—in this case for potatoes and wheat—are much lower than previously assumed (Das Gupta et al. 2010a, 2010b). The rates might be higher for the 5 percent or so of the Indian food economy that is of highly perishable produce, such as greens. But testing this hypothesis remains a gap in the literature.

are small, three—Uttar Pradesh, West Bengal, and Uttarakhand—stand out as important agricultural states. There thus appears to be correlations of adoption of the market reforms and the general politics of states, as well as the pressures of specific lobby groups within states.

Reardon and Minten (2011b) discussed the entry of retail and processing firms into direct procurement from farmers over the past seven to eight years, partly in the aftermath of APMC reforms in various states and partly operating within the APMC system using licenses. Their article presents a classification of the direct-procurement methods used:

- (a) Prior to or in the absence of APMC reform, companies set up collection centers by obtaining a license from APMC—examples are Spencer’s in Karnataka for the sourcing of produce and ITC’s Choupal Saagar and the e-Choupal hub-and-spoke system for grain procurement in Madhya Pradesh.
- (b) After APMC reform in a state, retailers and processors set up collection centers outside *mandis* (off-market), such as retailers and wholesalers like Reliance and Metro in Maharashtra and Safal (Mother Dairy) in Uttarakhand, or produce wholesale and processing companies, such as Adani, which has controlled atmosphere apple distribution centers in Himachal Pradesh. These collection centers are usually in peri-urban areas (up to four hours’ drive from Tier 1 or Tier 2 cities) and source highly perishable products (for example, greens) or semiperishables (such as cauliflower and tomatoes) for stores in the city.
- (c) Companies as well as public-private partnerships have set up various cluster platforms, such as private *mandis*, mega-food parks, integrated agrifood parks, private chains of rural business hubs (such as Hariyali Kisaan Bazaar), and logistic parks.
- (d) Companies have also started or extended contract farming (sometimes called a stand-in term such as *sponsored farming*) after APMC reform, such as Godrej Industries in Maharashtra.

The main difference between (a) and (b) is that (b) does not require an APMC license. However, our field research shows that this difference does not necessarily manifest itself as a clear, concrete advantage. For example, in Maharashtra, we found that off-market collection centers still officially have to pay a CESS to the APMC. Unofficially, they are often forced by the *network of actors* in the *mandi* system to have on premises weighing men who they must pay, even though these men are not officially required; this acts as an informal tax on the supposedly new and liberalized arrangements.

There is controversy about how extensive the rise of (a)–(d) has been during the past decade. Estimates have ranged from large and optimistic to small and pessimistic. However, as far as we know, there has been no pan-India, careful, neutral, systematic assessment and inventory of these initiatives. This is a clear gap in the research.

In 2009, we did a rapid-reconnaissance version of that inventory (discussed in detail in Reardon and Minten 2011b) in Maharashtra. We found that in the short span of three years (from the state’s APMC reform in 2005/06 to early 2009), 79 licenses had been granted for direct marketing (collection centers in rural areas), a number of contract farming schemes (with the euphemism *sponsored farming*) had been approved, and hundreds of licenses for *mandi* stalls had been granted to a number of retailers. Of the 79 licenses, 15 were for retail chains, with each setting up a number of collection centers in rural areas around the state, while the others were mainly for processors of fruit, grain, and cotton. We also visited key horticultural areas, such as around Pune, and found intensive competition among a number of retail chains with collection centers in the area. However, we also heard a series of stories about harassment of the new arrangements by the traditional *mandi* actors.

The Rise of Modern Private Food Wholesale and Logistics in India

In the past decade, there is emerging rapidly a modern-sector cluster of food logistics, distribution, and wholesale companies in India. Based on field case studies and a review of evidence, Reardon and Minten (2011b) traced the rise of this segment and noted its symbiotic links to the rise of modern retail in India. The main points are as follows.

First, modern food retailers in India are increasingly shifting toward the use of modern logistic and wholesale companies (and direct sourcing from manufacturers, as discussed earlier) and away from sourcing from traditional stockists and general-line wholesalers. This is especially true for processed, refrigerated semiprocessed and fresh food. In this sense, the food retailers are following a general trend that has been seen elsewhere in Asia and globally (Reardon and Timmer 2007; Farina et al. 2005 for dairy in Brazil and Argentina). Retailers do this in order to cut transaction costs, increase consistency of quality, and meet quality and safety standards and regulations. In the longer run in India, this change can have the same effect observed elsewhere of accelerating the tendency to consolidation in the processing, logistics, and wholesale sectors.

Some of the modern logistics companies involve backward integration by retailers (such as Future Logistics Solutions Ltd. of Pantaloon/Future Group and Advanced Logistics Asia of Metro Group). Others were started earlier, with retail being a forward integration from them (such as the Radhakrishna Foodland—although their retail chain was started and then discontinued and they now focus only on logistics). Moreover, modern retailers use the services of independent modern logistics companies that were either emerging in the 2000s or have grown rapidly since then. Several leading examples include the following: Concor (the Container Corporation of India) provides logistics for Bharti-Walmart, Pantaloon, and Mother Dairy. Agility Logistics (US) had a turnover in 2008 of US\$7 billion, of which US\$4 billion was outside the United States. In 2009, Agility was investing US\$130 million in India and was by then already a leading modern logistics firm (Armstrong and Associates Inc. 2009), with several modern retail chains and fast-moving consumer good companies as clients in India. Snowman Frozen Foods (Japan) is said to be the first and largest cold chain—cum—logistics independent firm with a pan-Indian presence. Snowman moves products (mainly dairy, processed foods and pulps, seafood, and meat) in refrigerated trucks from supplier to cold-Distribution center (DC) to retailers (such as Bharti) and processors (FnBNews 2008). Finally, a development of importance is the emergence of procurement system partnerships between Indian modern retail chains and global chains involved in cash-and-carry joint ventures with the Indian chains, such as Walmart's partnership with Bharti. Metro (Germany) has its own stand-alone cash-and-carry hypermarkets in India.

Second, the corollary of the first point is that modern retail's emergence appears to be advantageous and encourages India's food logistics and distribution sector (FnBNews 2008). VcCircle (2007), a leading investor site, noted, "Logistics see a great potential in the wake of a retail revolution, and so companies are game to capitalize on this high growth opportunity." In addition, the Hindu Business Line (2006) noted that multinational logistics firms are being attracted by the rise of modern retail: "The port-based container logistics company Gateway Distriparks Ltd. is foraying into the cold chain logistics segment, expecting a surge in domestic demand for movement of frozen and chilled food in the wake of the boom in the retail sector." At present, this symbiosis is just a hypothesis, as there has not been systematic research on it, but the trend appears to be headed in this direction.

Third, other factors are also promoting third-party food logistics investments. The *Economic Times* (2009) noted that although only 20 percent of the logistics sector is organized and the rest is informal, this percentage could rise with a reduction in intermediation due to a shift from multiple warehousing to regional-based logistics with a revision of the tax regime. Specifically, a planned rollout of the goods and service tax would shift the taxation to a consumer tax. This rollout was slated for April 2010, though it now appears that it will be delayed for several years. Moreover, as part of the Indian 2009/10 budget, there is a tax exoneration for cold chain investments, which provide a further fillip to that sector.

Ferment and Change in the Traditional Wholesale Sector

It strikes us that a common view in the Indian debate is that the rural economy is in long-term stasis. It is seen to be in an unchanging traditional system of privileged wholesalers dominating trade and village collectors or brokers dominating the interface of the market with the farmer, with both extending credit to farmers to *tie output and credit markets*, with little storage, little competition among types of actors, and overall long supply chains with many actors, from the farmer to the city. This image has been painted accurately and empirically in leading accounts, such as Lele (1971).

We find, however, that instead of a stagnant rural market economy, there appears to be great ferment and rapid transformation. It appears not to be happening at the same rate or in the same way in all rural zones, but rather to be concentrated in certain areas—primarily in the swaths of agricultural areas within the vast market catchment areas within six to eight hours of Tier 1 and Tier 2 cities. Although these areas—which we can call *dynamic areas*—may not be typical of traditional and hinterland rural areas, they do include a substantial share of the rural Indian population and probably a large share of the food supply to cities. Recent farm, mill, cold store, and trader surveys in west, central, and eastern Uttar Pradesh and Madhya Pradesh (Das Gupta et al. 2010a, 2010b; Reardon, Minten, Punjabi Mehta, Das Gupta, Rajendran, and Singh 2011; Reardon, Minten, Punjabi Mehta, Das Gupta, Rajendran, Sarawgi, et al. 2011) share certain key findings that run counter to conventional wisdom about rural markets. We present general findings from these studies (as well as findings from comparable surveys in several areas of Bihar and Uttarakhand, such as Minten, Reardon, Singh, and Sutradhar [2010] and Minten et al. [2009]) and refer the reader to the reports for details.

First, rural traditional market transformation is much more advanced in certain regions of the study states than in others. For example, the west and central regions of Madhya Pradesh (Malwa Plateau) and west and central Uttar Pradesh are sharply different from the east regions of each of those states, per the survey findings. The average farm size is larger, farmland distribution is more unequal (with 30 percent of farmers owning 70 percent of farm land), land rental share is higher, marketed surplus rate is higher, incomes are higher, livestock holdings and milk output are much higher, chemical and fertilizer use is higher, credit use is higher, and all indices of traditional market transformation are much higher. By contrast, the east of each of the states looks more like the conventional image of traditional rural India.

Second, the same types and directions of differences that the surveys showed over regions were also manifest over farm size strata. The marginal farmer strata (0–1 hectares) looked much like traditional rural India, with low marketed surplus, chemical use, and credit use; low participation in transformed traditional markets (that is, they still sell mainly to village collectors); lower use of cold stores; and so on. By contrast, the small farmers in the dynamic areas and the medium farmers in all zones had assets and behavior corresponding to what we described for the dynamic zones in general. Thus, transformation is differentiated by zone and farm size, with the smallest and the most hinterland relatively left out of the emerging changes—much as one sees in other developing countries. (In the points below, we focus on the changes and then abstract from comparison with the less-changed or unchanged situation.)

Third, it is usually assumed that staple food supply chains are dominated by long chains, which is supposed to lead to inefficiencies. For example, Mattoo, Mishra, and Narain (2007) and Landes and Burfisher (2009) argued in the case of India that most agricultural trade is mediated by a large number of intermediaries, which not only inflate prices but which also take time to move products from farmers to consumers, leading to large transit costs. However, our surveys showed that the role of the village/field broker is quite limited, as is the role of the local *haat*¹² (as a share of market surplus from farmers). The terms *disintermediation* and *supply-chain shortening* come to mind, as these terms are usually found in current debate applied to the modern sector (such as supermarkets or processors buying direct from farmers). We find that this is happening in traditional chains as well, with a sharp reduction in the role of the traditional village broker/collector. (This finding is emerging elsewhere in Asia; see Natawidjaja et al. 2007 for Indonesia and Huang et al. 2007 for China.) Rather, the majority of the farmers (and the great majority

¹² A *haat* is a traditional periodic market usually in rural areas.

of the marketed surplus) is sold directly to the wholesale markets (*mandis*); in the case of grain and soybeans, to the mills; and in the case of potatoes, mostly at the cold stores (onto traders and other actors) rather than at the *mandis*.

Fourth, it is often assumed that farmers in India are typically at the mercy of a field broker and are not very informed on markets or that they might be getting low prices because of tied credit (see, for example, Basu 1986; Bell 1988; Bell and Srinivasan 1989; Basu 2010). However, all of our surveys showed that fewer than 5 percent of farmers received any advance payment (such as for inputs at the start of the season) or indeed any credit in any form from brokers or wholesalers. Our trader surveys showed the same picture. In follow-up informant interviews (done to interpret our results), traders and farmers essentially told us: “Some 15 or 20 years ago, it was common for traders to extend credit to farmers. This practice has nearly disappeared because farmers have many options, roads are better, there is more credit available (such as from Kisaan credit cards), and they have mobile phones.” Das Gupta et al. (2010a) found, for instance, that a large number of farmers now possess a mobile phone and use it actively to conduct their business; it is estimated that almost 80 percent of the interviewed potato farmers contacted multiple buyers by phone, and almost half of the potato farmers in the hinterland of Delhi settled on a price by phone in their last transaction.

Fifth, our surveys (Das Gupta et al. 2010a; Minten, Reardon, Singh, and Sutradhar 2010) showed rapid development—diffusion and scale increase—of cold stores for potato in Uttar Pradesh and Bihar in the 2000s. This development raised farm prices and reduced seasonality for consumers. Sales directly by farmers to traders at cold stores were shown in western Uttar Pradesh to greatly diminish the role of the *mandi* in that region, even though the APMC has not been reformed. Of the farmers surveyed in western Uttar Pradesh, 95 percent were found to be using cold stores in 2009, versus 40 percent (estimated by Singh 2008) in 2000 and a small minority in the early 1990s (Fuglie et al. 1997). The cold stores were also used by most traders. Moreover, the surveys showed cold storages are increasingly involved in input, output, and credit markets.

5. CONCLUSIONS: A QUIET REVOLUTION IN INDIA'S FOOD SUPPLY CHAINS IS EMERGING BUT STILL CONSTRAINED

The evidence discussed in this paper indicates that from the midst of the traditional rural areas are emerging areas of rapid transformation, whether from the involvement of the modern sector or from the transformation of traditional supply chains. This transformation is mirrored, though in a more concentrated way and at a faster pace, in the urban food economy. We have shown that, by far, the main actors in this unfolding *quiet revolution* are the private sector—whether modern or traditional. We found that the government's direct role (as buyer and seller) is only 7 percent of India's food economy, even if that share is as much as 25 percent in the 25 percent of the food economy which is grains. The private sector, both modern and traditional, decides India's food security.

It is clear that the economic environment, in league with policy change, has been crucial in spurring the quiet revolution in food supply chains. A host of liberalization policies, combined with public investments, has spurred an avalanche of private investments by farmers, traders, cold stores, mills, and retailers. Equally clear, however, is that there persists a number of constraints to continued transformation. We are neutral researchers and name these constraints only to inform what limits the transformation of the supply chain. Addressing (or not) those constraints and furthering (or not) the transformation are political decisions of the Indian government and people; we do not take a stance on what India should do.

The first persisting constraint is asset poverty and policies that do not yet address it sufficiently. The elements of asset poverty include collective assets, such as poor roads and lack of electricity in the poorer regions (such as eastern Uttar Pradesh). They also include individual assets, such as education, tubewells, and credit access. In separate work (Reardon, Minten, Punjabi Mehta, Das Gupta, Rajendran, and Singh 2011; Reardon, Minten, Punjabi Mehta, Das Gupta, Rajendran, Sarawgi, et al. 2011; Rao et al. 2011), we showed that state and cooperative supply of subsidized tubewells, credit, fertilizer, and seed are heavily biased toward medium and large farmers in the study areas discussed. Broadening the infrastructure and distribution of public goods and services to poorer areas and strata are major challenges.

The second persisting constraint is that unlike most of the rest of Asia—and perhaps most strikingly China and Southeast Asia—India's continuing constraint on foreign direct investment in food retail means that it still forgoes that source of investment capital and expertise, as well as the incremental gains to urban food security that retail transformation brings. This may be a moderate constraint, because domestic retail investment is far more vigorous (and fueled by cash-rich conglomerates) in India than in many other countries.

The third persisting constraint is midstream in the various continuing policy-based limitations to direct procurement from farmers by retailers, processors, and modern wholesalers. Among the policy issues are the following: (1) partial or slow liberalization of wholesale markets (Agricultural Produce Market Committees [APMC] reform); (2) limits on private-sector procurement, storage, and sales to traders—Storage Control Orders under the Essential Commodity Act; and (3) regulatory and fiscal uncertainty and transaction costs, such as double taxation for interstate movement.

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